

**REMARKS**

Claims 1-21 are pending. Claim 1 has been amended.

Claim 1 has been amended as follows. The order of the elements has been altered to clarify the relationship between them. As amended, claim 1 requires that the surface modified nanoparticles be dispersed in the first and second liquids. Support for this amendment can be found at, e.g., page 5, lines 3-4; page 7, lines 6-7; and page 8, lines 13-16.

**Compatibility**

According to the Patent Office, “‘compatibility’ is considered to be represented by good solubility and miscibility characteristics.” With respect to concept of compatibility, the Patent Office also asserted that “Applicant has acted as his or her own lexicographer to specify a term of a claim contrary to its ordinary meaning.” (See Office Action mailed April 5, 2006; ¶ 4.) Applicants respectfully traverse.

Applicants respectfully submit that they have used the term “compatible” in a manner consistent with the Patent Office’s definition. (See, e.g., page 7, lines 15-20 (“The surface-modified nanoparticles have surface groups that modify the ‘solubility’ or ‘wettability’ characteristics of the nanoparticles”) and lines 28-30 (“If the nanoparticles are not compatible with, or have very low compatibility with a particular liquid, they will not be sufficiently wet by that liquid ...”); and page 8, lines 13-16 (“The surface modification of the nanoparticles will allow them to be compatible with the liquid materials so that they can completely disperse.”))

However, because claim 1 does not use the term “compatible” in isolation, but rather requires the surface modified nanoparticles to be “more compatible with” the first liquid than with the second liquid, Applicants’ specification provides a method of assessing such relative compatibility. (See page 7, line 21 – page 8, line 9.) Generally, Applicants’ method of assessing relative compatibility relies on the concept that “[a] liquid having a lower rate of viscosity build is more compatible with the nanoparticles than a liquid having a higher rate of viscosity build.” (Page 7, lines 25-26.) Applicants respectfully submit that the results obtained by this method are consistent with generally accepted concepts of relative compatibility. (See, e.g., U.S. Patent No. 6,467,897 (Wu et al.), at col. 11, lines 33-47, (issued Oct. 22, 2002).)

**Background**

Claim 1 requires, *inter alia*, a first liquid having a vapor pressure VP1 and a second liquid having a vapor pressure VP2. The first and second liquids are required to be miscible. Also, VP2 must be less than VP1. Claim 1 also requires surface modified nanoparticles. These nanoparticles are dispersed in the first and second liquids. In addition, the surface modified nanoparticles are more compatible with the first liquid than the second liquid. That is, the nanoparticles are more compatible with the liquid having the higher vapor pressure.

Generally, a liquid having a higher vapor pressure at the drying conditions will be removed preferentially relative to a liquid having a lower vapor pressure. In some embodiments, more than one liquid will be removed simultaneously; however, the liquid with the higher vapor pressure will be removed at a higher rate relative to the liquid with the lower vapor pressure. (See page 5, lines 15-19.) In some embodiments, the lower vapor pressure liquid is solidified (e.g., cured or crosslinked). (See, e.g., page 5, lines 6-8; and page 13, lines 4-8.)

In either case, the surface modified nanoparticles are more compatible with the liquid having the higher vapor pressure, i.e., the liquid that is generally preferentially removed. For example, if the coating solution comprises a first liquid that is removed and a second liquid that is solidified to aid in forming the film, then the surface-modified nanoparticles should be more compatible with the first liquid than with the second liquid. Alternatively, if more than one liquid is to be removed (e.g., evaporated) from the coated solution, the compatibility of the nanoparticles with the tail solvent (i.e., the lowest vapor pressure liquid) should be less than the compatibility of the nanoparticles with the higher vapor pressure liquid(s). (See claim 1, and page 13, lines 4-12.)

**Rejection under 35 USC § 103**

Claims 1-21 stand rejected under 35 USC § 103(a) as being unpatentable over Ducoffre et al. (US Patent No. 6,649,672) in view of Houlihan et al. (US Patent No. 6,700,708).

Without acknowledging that proper motivation exists to combine the references, Applicants respectfully submit that the Patent Office has failed to show how the combination of references describes, teaches, or suggests all elements of the claimed invention. For example, the Patent Office has failed to show how the combination of references describes, teaches, or

suggests surface modified nanoparticles dispersed in both a first liquid and a second liquid that is miscible with the first liquid.

Although Ducoffre describes surface modified nanoparticles, these particles are not dispersed in liquids, rather the surface modified nanoparticles are reacted with an epoxy binder. (See, e.g., col. 3, lines 29-30.) According to Ducoffre, the binder modified with nanoparticles can be mixed with further constituents and used as coating compositions. (See, e.g., col. 5, lines 3-8.) Such further constituents include further binders (see col. 6, lines 45-50) and solvent (e.g., organic solvents and/or water) (see col. 6, lines 60-62).

Although Ducoffre attempts to incorporate the unreacted nanoparticles in a clear lacquer, Ducoffre expressly states that this attempt was unsuccessful. (See Example 5, col. 8, lines 16-19.) Therefore, Applicants respectfully submit that the Patent Office has failed to show how Ducoffre describes, teaches, or suggests that the surface modified nanoparticles themselves are dispersed in any of the “further constituents” of Ducoffre.

Assuming, *arguendo*, that the reaction product of the surface modified nanoparticles with the epoxy resin of Ducoffre could be considered to be the surface modified nanoparticles of the present invention, the proposed combination of references still fails to describe, teach, or suggest all elements of the claimed invention. For example, the Patent Office has failed to show how the references describe, teach, or suggest the dispersion of the epoxy binder modified with nanoparticles in two miscible liquids, wherein the two liquids have the required relationship of compatibility and vapor pressure as set forth in, e.g., claim 1.

First, Ducoffre explicitly states that

[t]he binders modified with nanoparticles according to the invention do not exhibit any compatibility problems between the nanoparticles and further constituents of the binders, or of the coating compositions, either during their production or storage, during or after their incorporation into coating compositions, or curing or after application of the coating compositions.

(Col. 7, lines 20-26.) Thus, Ducoffre teaches away from the present invention which requires “surface modified nanoparticles dispersed in the first liquid and the second liquid, wherein the nanoparticles are more compatible with the first liquid than with the second liquid.” (See, e.g., claim 1.)

Second, although Ducoffre mentions that coating compositions may contain solvents, the Patent Office has failed to show how Ducoffre describes, teaches, or suggests the selection of any particular solvent, nonetheless the selection of two or more miscible solvents (i.e., liquids) wherein the first liquid has a vapor pressure, VP1, and the second liquid has vapor pressure, VP2, that is less than VP1, and wherein the surface modified nanoparticles (i.e., in the case of Ducoffre, the epoxy binder reacted with the surface modified nanoparticles) are more compatible with the first liquid than with the second liquid.

According to the Patent Office, Houlihan “teaches that when the epoxy resin is uncured and filled with nanoparticles, the resin must have good solubility in a solvent such as 1-methoxy-2-propanol acetate ...” According to the Patent Office, Houlihan also teaches that “if the epoxy is filled with nanoparticles, it should be able to retain a suspension of particles ...” Finally, the Patent Office concludes that it would have been obvious to use the 1-methoxy-2-propanol acetate of Houlihan as the solvent for the nanoparticle-containing epoxy resin compositions of Ducoffre “to achieve good solubility and miscibility characteristics.”

First, as discussed above, the Patent Office has failed to show how Ducoffre describe, teach, or suggest an epoxy filled with nanoparticles. Rather, Ducoffre teaches surface modified nanoparticles reacted with an epoxy resin. The Patent Office has failed to show how, once the nanoparticles are reacted with the epoxy resin, that the solvent of Houlihan or any solvent could dissolve the epoxy resin and retain a suspension of the nanoparticles reacted with that same epoxy resin. Absent such a showing, Applicants respectfully submit that the Patent Office has failed to provide a proper motivation to combine the references.

Second, even assuming, *arguendo*, proper motivation existed to select the solvent of Houlihan for combination with the nanoparticle-modified epoxy resin of Ducoffre, the Patent Office has still failed to show how this combination describes, teaches, or suggests all elements of the claimed invention. For example, the Patent Office has failed to show how either Ducoffre or Houlihan describes, teaches, or suggests the selection of a second liquid miscible with the 1-methoxy-2-propanol acetate of Houlihan, wherein the second liquid is chosen to give the proper relation between the vapor pressures and compatibilities with the surface modified nanoparticles as required by, e.g., claim 1.

In summary, the Patent Office has failed to show how Ducoffre and Houlihan describe, teach, or suggest all elements of the claimed invention. For at least these reasons, the rejection of claims 1-21 under 35 USC § 103(a) as being unpatentable over Ducoffre et al. (US Patent No. 6,649,672) in view of Houlihan et al. (US Patent No. 6,700,708) has been overcome and should be withdrawn.

In view of the above, it is submitted that the application is in condition for allowance. Reconsideration of the application is requested, and allowance of claims 1-21, as amended, at an early date is solicited.

If any additional issues remain, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number provided below.

Respectfully submitted,

Date June 30, 2006

By: Thomas M. Spielbauer  
Thomas M. Spielbauer, Reg. No.: 58,492  
Telephone No.: 651-736-9814

Office of Intellectual Property Counsel  
3M Innovative Properties Company  
Facsimile No.: 651-736-3833